Environment and Natural Resources Trust Fund
2017 Request for Proposals (RFP)

Project Title: **ENRTF ID: 119-D**

Adapting Stream Barriers to Remove Invasive Fish

Category: D. Aquatic and Terrestrial Invasive Species

Total Project Budget: $ 381,150

Proposed Project Time Period for the Funding Requested: 1.5 years, July 2017 - December 2018

Summary:

Field tests at existing barrier sites and laboratory experiments to adapt a recently developed technology to remove invasive carp from streams during their spawning migrations in Minnesota.

Name: Przemyslaw Bajer

Sponsoring Organization: U of MN

Address: 2003 Upper Buford Cir, 135 Skok Hall

St. Paul MN 55108

Telephone Number: (651) 335-6261

Email bajer003@umn.edu

Web Address

Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Description of carp spawning migrations and technology that could be used to remove these fish

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

PROJECT TITLE: Adapting stream barriers to remove invasive fish during their seasonal migrations

I. PROJECT STATEMENT

The overarching goal of this proposal is to develop a system that can remove large numbers of invasive common carp during their spawning migrations at existing barrier sites in streams. Adopting an existing technology recently developed for salmon in western United States could do this.

Common carp are the most wide-spread and damaging invasive fish in Minnesota. They exhibit a unique behavior that if exploited could greatly accelerate their management schemes. In the spring, up to 90% of carp migrate from lakes to marshes to spawn. Often, thousands of carp are seen moving through small streams and creeks over the course of few weeks in May and June (Fig. 1). If these carp could be removed, many populations could be managed in a sustainable way. Unfortunately, it is difficult to predict exactly when carp will migrate, most move at night, and the ones that are seen at barrier sites during the day scare easily and are difficult to capture. A technology is needed that will exploit carp's natural tendency to swim through narrow passages as they try to cross the barrier, which will remove them at the same time.

Many existing carp barriers, of which hundreds are present across Minnesota, could be modified to remove carp while allowing the passage of native fish. Whooshh Innovations (http://www.whooshh.com) has recently developed a system that can accomplish that. In this system, an entry way is placed near the barrier seemingly allowing the fish an easy passage. Once a fish crosses the entrance it is being sucked into a vacuum chamber and is then being pneumatically carried forward though a flexible tube. Image recognition systems inside the apparatus could determine species identity and invasive fish could be directed into containment while native fish are carried across the barrier. This system is becoming popular in western United States to allow salmon and steelhead cross impassable dams, and could be adopted to remove migratory invasive fish in Minnesota.

The direct goal of this proposal is to adopt the existing Whooshh system to allow for selective removal of common carp during their spawning migration while enabling the passage of native fish. This will be accomplished by conducting field trials during two springs at sites where carp barriers already exist and where spring migrations have been documented in the past, while laboratory tests will focus on species-specificity.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Field tests **Budget: $224,075**

We will select two sites with existing carp barriers and where large carp migrations occur each year. We will modify existing barriers by attaching specially designed entry ways that will direct fish into the Whooshh system. Carp and native fish will be directed into two separate cages and we will determine what percentage of migrating carp can be successfully captured and sorted. We will conduct these tests during carp migration to the spawning sites as well as during their return to test both up- and downstream scenarios. Passive Integrated Transponders (miniature electronic tags) and PIT antennas positioned up- and downstream of the barrier sites will be used to quantify the efficiency of carp passage and capture.

Outcome	Completion Date
1. First field season completed. Improvements communicated to Whoosh engineers	*Dec 31, 2018*
2. Second field season completed, system optimized and tested. Data analysis, reports and peer-reviewed manuscripts submitted	*Dec 31, 2019*

Activity 2: Laboratory tests of various entry ways and species-specificity **Budget: $ 157,075**

We will conduct laboratory analyses using fish of various species and sizes to determine the effectiveness with which Whooshh system can distinguish and sort between carp and native species. We will also test and optimize various entry ways based on our findings in the field. Separate tests will be conducted during the day and at night to mimic realistic field conditions (carp often migrate at night). While conducting these tests we will also test for potential fish injuries using established protocols (Whoosh system has been already shown to be non-injurious to sensitive salmon and steelhead thus we expect that it will be also non-injurious to native fishes such as the northern pike that often migrate with the carp). These laboratory tests will yield behavioral observations that we will use to design optimal entry ways for fish migrating up- and down-stream.

Outcome	Completion Date
1. Tests of entry ways and species specificity completed	*Dec 31, 2018*
2. Data analyzed, reports and peer-reviewed publications submitted	*Dec 31, 2019*

III. PROJECT STRATEGY

A. Project Team/Partners

Receiving ENRTF money: Bajer – PI, 10% salary 2.5 yrs, post-doctoral researcher 100% salary 2.5 yrs to conduct the experiments; 1 field technician 50% to assist in the field during 2 springs.

Partners and collaborators: Claire Bleser – Riley Purgatory Bluff Creek Watershed District, Matt Kocian - Rice Creek Watershed District, Bill Bartodziej – Ramsey Washington Metro Watershed District, in-kind support and infrastructure at carp barrier sites.

B. Project Impact and Long-Term Strategy

Innovative ways to remove invasive fish during their spawning migration would enable effective and practical management strategies for common carp and possibly also other invasive fish in Minnesota. Many watershed districts would be trained on how to use and adopt this technology in their specific locales. This project is also of interest to MN DNR and groups involved in efforts to restore native fishes by increasing passage over dams and improving connectivity between bodies of water.

C. Timeline Requirements

This is a 2.5 -year project to accommodate two field seasons and additional 6 months to write and submit peer-reviewed publications.

2017 Detailed Project Budget

Project Title:*Adapting stream barriers to remove invasive fish during their seasonal migrations*

IV. TOTAL ENRTF REQUEST BUDGET: 2.5 years

BUDGET ITEM	AMOUNT
Personnel:	
Bajer, Project manager (81% salary, 19% benefits), 10%FTE yrs 2.5	$ 25,000
Postdoc (66.3% salary, 33.7% benefits), 100% FTE for2.5 yrs	$ 167,100
Field Technician to coord. & conduct field work (66.3% salary, 33.7% benefits) 50% FTE 2 yrs	$ 60,000
Professional/Technical/Service Contracts:	$ -
Equipment rental for 2 years	$ 105,000
Equipment/Tools/Supplies: (1000 PIT tags; PIT antenna)	$ 7,000
Perishable field gear: waders, containers, dip nets, etc.	$ 4,000
Travel in MN:	$ 9,050
Mileage (~5000 miles) to experimental sites x $0.37 mile + truck rental U of M $900/month x 4 months x 2 years	
Additional Budget Items: fees to publish in peer-reviewed journals	$ 4,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST	$ 381,150

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:	NA	
Other State $ To Be Applied To Project During Project Period:	NA	
Funding History: $413,300 - ENRTF 2016-2018: Managing carp using biocontrol and toxins	$ 413,000	
Remaining $ From Current ENRTF Appropriation:*Bajer is 100% on LCCMR/MAISRC through 2019; Managing carp using biocontrol and toxins; salary swap of 10% per year between existing projects and this project could be used to save money*	$ 20,000	*Other*

Each spring, up to 90% of common carp migrate from lakes to marshes using small streams

Thousands of common carp below a barrier in Purgatory Creek, MN. These fish migrate each year from the lake in which they overwinter into a shallow marsh 1 mile upstream.

Capturing these fish would accelerate carp management in many locales. Carp's tendency to challenge barriers could be used against them by creating openings in barriers that lead into devices that remove carp.

An existing technology developed to transport salmon over dams could be modified to remove migratory common carp from many barrier sites in MN
Photo: Whooshh Innovations
Videos:
http://www.whooshh.com/fish-passage1.html

We propose two activities to:

1. Adapt the existing technology so that it can be used for carp removal in MN
2. Test if the device can distinguish between carp and native species so that carp are removed while migrations of native fish are enhanced

Proposal title: Adapting stream barriers to remove invasive fish during their seasonal migrations

Statement of Qualifications

Przemyslaw G. Bajer, Ph.D.,
Research Assistant Professor
University of Minnesota
Department of Fisheries, Wildlife and Conservation Biology
135 Skok Hall, 2003 Upper Buford Circle, St. Paul, MN, 55108, USA
Phone: (612) 625 6277, E-mail: bajer003@umn.edu

Dr. Przemyslaw Bajer is an expert on common carp ecology and management. He has been working at the University of Minnesota since 2006 developing sustainable management schemes for carp populations, several of which are being currently implemented across Minnesota. He has extensive experience with various aspects of carp migrations between lakes and marshes and with various carp removal schemes. He has published 28 peer reviewed publications, including 14 on common carp. He has successfully supervised graduate students and managed LCCMR projects.

Organization Description:

Established in 1851, the University of Minnesota is Minnesota's flagship, land grant university. With over 16,000 graduate and professional students, it's the largest research university in Minnesota. Its broad mission is to change lives through research, education, and outreach.